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Technical Report 15-TR

TEST AND EVALUATION OF A BAUDOT-FIELDATA CODE CONVERTER, PAPER TAPE

Task 4A623501D85309

9 August 1963

FORT BELVOIR VA

AD ______ Accession No. ______

U. S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Virginia - TEST AND EVALUATION OF A BAUDOT-FIELDATA CODE CONVERTER, PAPER TAPE - Alden E. Luke

Report 15-TR, 9 Aug 63, 26 pp, 6 illus, 3 tables
DA Task 4A623501D85309 (Contract DA-44-009 ENG-4737)
Unclassified Report

Report covers the combined engineer-acceptance tests of a Baudot-Fieldata Code Converter, Paper Tape. These tests were conducted to investigate the capabilities and to determine the limitations of this equipment for performance of specialized code conversion functions and to insure compliance with the purchase description. Report describes the machine construction and operation and the procedures for and methods of testing the production capability and reliability of the machine. Results of these tests are discussed herein. Report concludes that: (a) The Converter will perform the specialized code conversion function for which it was designed and can be used in a production facility where this function is required. (b) The operational capability of the Converter, including quality of output and speed of operation, meets the requirements of the purchase description. (c) The general arrangement of mechanical components is inadequate from a human factors standpoint. (d) A continual preventive maintenance program, primarily for lubrication, is required. This program can be administered by laboratory personnel. (e) Controlled temperature and humidity are necessary for good performance.

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2. Contract DA-44-009 ENG-4737

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U. S. ARMY ENGINEER
GEODESY, INTELLIGENCE AND MAPPING RESEARCH AND DEVELOPMENT AGENCY

Technical Report 15-TR

TEST AND EVALUATION OF A BAUDOT-FIELDATA CODE CONVERTER, PAPER TAPE

Task 4A623501D85309

9 August 1963

Distributed by

The Director
U. S. Army Engineer
Geodesy, Intelligence and Mapping Research and Development Agency

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THE VIEWS CONTAINED HEREIN REPRESENT ONLY THE VIEWS OF THE PREPARING AGENCY AND HAVE NOT BEEN APPROVED BY THE DEPARTMENT OF THE ARMY.

PREFACE

The authority for test and evaluation of the Baudot-Fieldata Code Converter, Paper Tape is contained in Task 4A623501D85309, "Utilization of Radar Presentations for Topographic Mapping." A copy of the task card is contained in Appendix A.

Work on this project was accomplished by Alden E. Luke under the supervision of Dale E. Howell, Chief, Data Reduction Branch, and under the direction of Randall D. Esten, Chief, Photogrammetry Division.

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SUMMARY

This report covers the combined engineer-acceptance tests of a Baudot-Fieldata Code Converter Paper Tape, developed under Contract DA-44-009 ENG-4737. These tests were conducted to investigate the capabilities and to determine the limitations of this equipment for performance of specialized code conversion functions and to insure compliance with the purchase description.

The report describes the machine construction and operation and the procedures for and methods of testing the production capability and reliability of the machine. The results of these tests are discussed herein.

This report concludes that:

a. The Converter will perform the specialized code conversion function for which it was designed and can be used in a production facility where this function is required.

b. The operational capability of the Converter, including quality of output and speed of operation, meets the requirements of the purchase description.

c. The general arrangement of mechanical components is inadequate from a human factors standpoint.

d. A continual preventive maintenance program, primarily for lubrication, is required. This program can be administered by laboratory personnel.

e. Controlled temperature and humidity are necessary for good performance.

TEST AND EVALUATION OF A

BAUDOT-FIELDATA CODE CONVERTER, PAPER TAPE

I. INTRODUCTION

1. Subject. This report covers the combined engineer-acceptance tests performed on a Baudot-Fieldata Code Converter, Paper Tape. These tests were conducted to investigate the capabilities and to determine the limitations of this equipment for performance of specialized code conversion functions.

2. Background. A uniform coding system was recently standardized and proposed for use with Army-developed computers. This coding system, termed the Fieldata system, was also to be used for mapping equipment which required punched paper tape input, punched paper tape output, or both. Accordingly, two major developments for which GIMRADA had awarded contracts required Fieldata paper tape input as well as computational services of a medium-scale Fieldata computer. These developments were: (1) Side-looking radar map compilation equipment for Task 4A623501D85309, "Utilization of Radar Presentations for Topographic Mapping," and (2) an Automatic Point Reading, Plotting and Grid Ruling Machine for Task 8T35-09-001-06, "Cartographic Drafting Methods and Equipment."

It was apparent that a Fieldata computer would not be available to provide the necessary input data for engineering tests of this equipment. Therefore, it was proposed to use the available Recomp II computer to compute the input data and develop a code conversion device to convert the data to the Fieldata code. The conversion device would be necessary because the Recomp II computer uses the Baudot coding system for both internal logic and external input-output control. Contract DA-44-009 ENG-4737 was therefore awarded to International Business Machines Corp., Kingston, New York, for the development of a Baudot-Fieldata Code Converter, Paper Tape.

II. INVESTIGATION

3. Description of Equipment. The Baudot-Fieldata Code Converter, Paper Tape (hereafter referred to as Converter) provides facilities for conversion of paper tape stored data from Baudot code to the Fieldata code and vice versa. In addition, facilities are provided for a hard copy printout of the data which are punched in the output tape. Tapes can be duplicated in either code, and a

manual keyboard allows the operator to originate new tapes in either code.

The Converter consists of a desk-type inclosure in which are mounted two paper tape readers, two paper tape punches, a page printer, and the electronic code conversion circuitry with its associated power supplies. Both readers and punches operate at a high-speed rate of 50 characters per second and a low-speed rate of 10 characters per second. The high-speed rate is for tape-to-tape conversion or duplication with no hard copy output on the page printer. When hard copy is being produced, the operating speed is reduced to that of the page printer or 10 characters per second.

Figure 1 shows a general view of the Converter in closed position, and Fig. 2 shows the Converter in operating position. Paper tape readers are in front of the left pedestal, punches are in front of the right pedestal, and the page printer is on top of the housing. The readers and punches rest on retractable trays and are accessible behind drop down face panels.

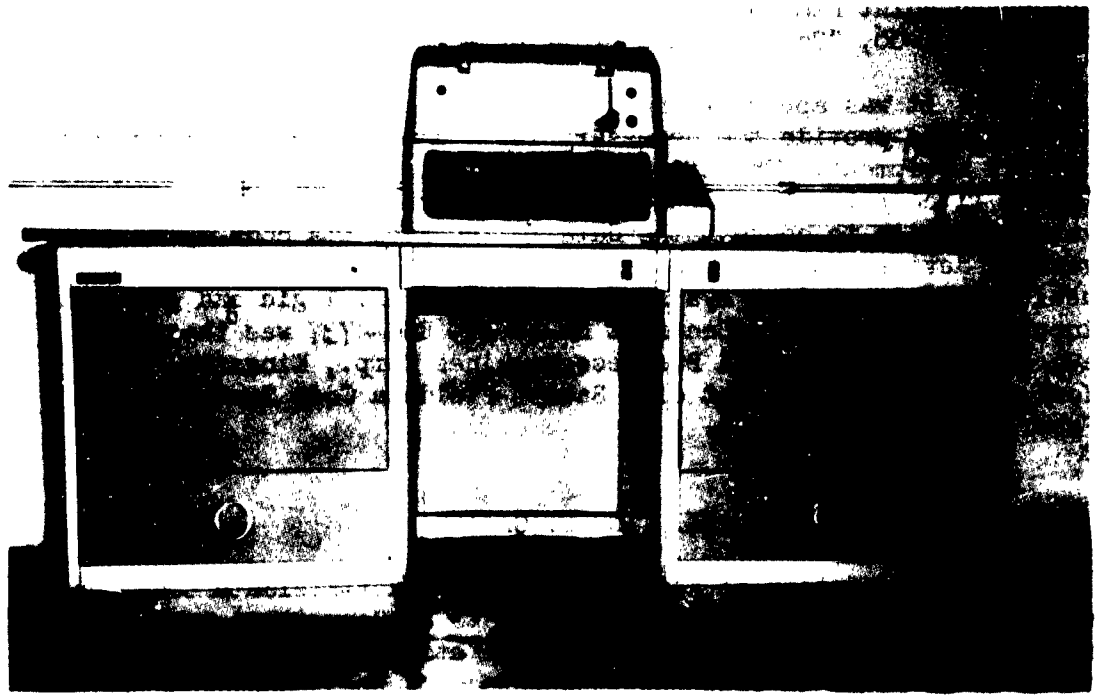

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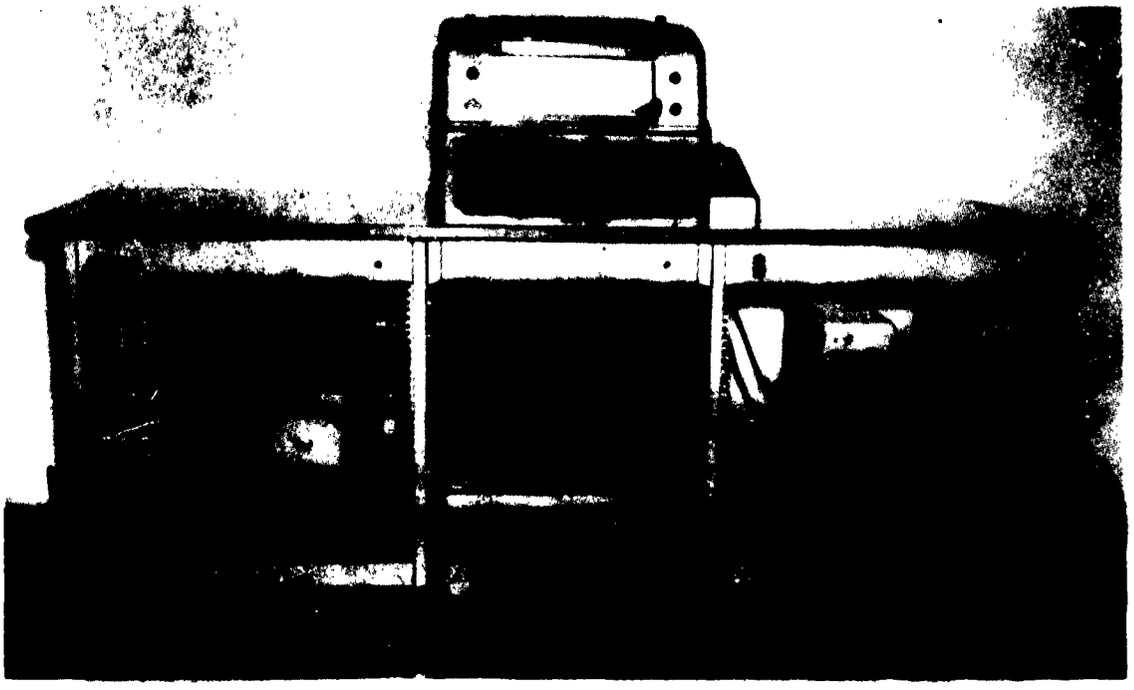
Fig. 1. Baudot-Fieldata Code Converter, Paper Tape.



K2498

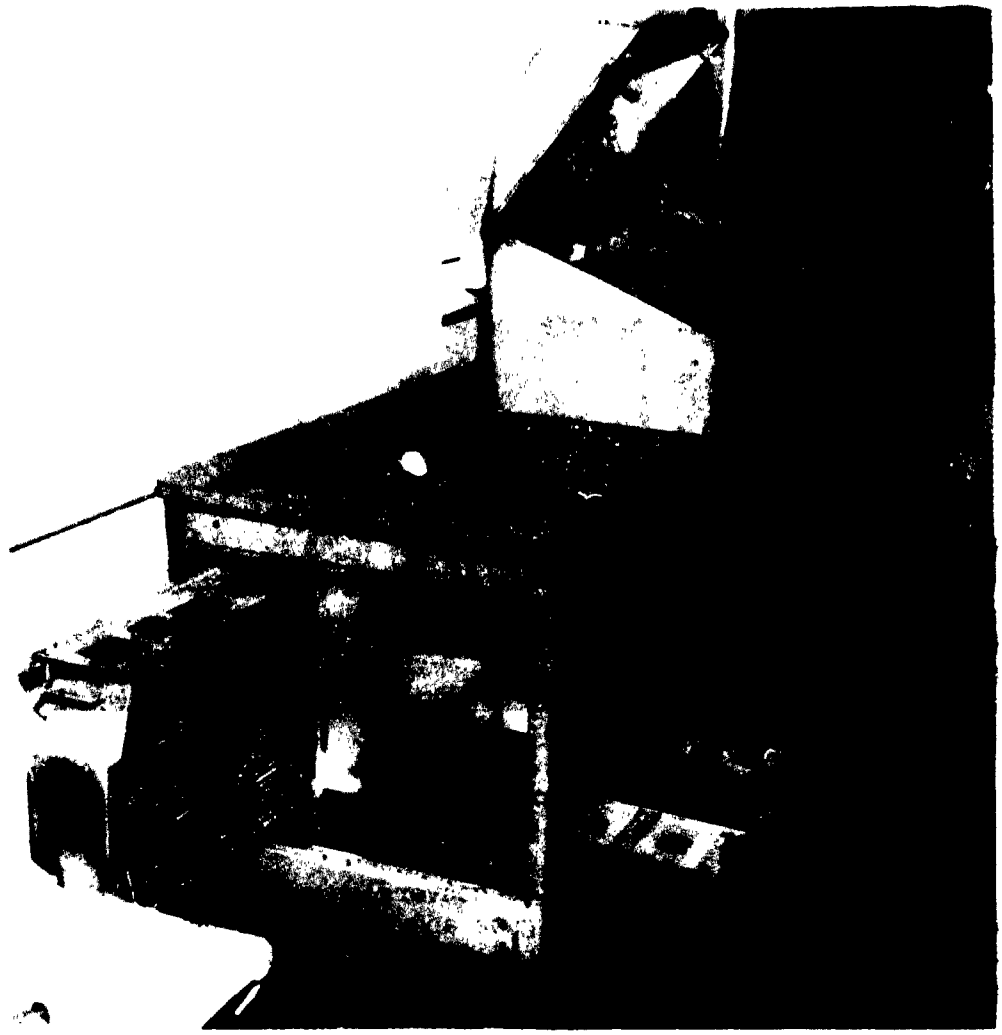
Fig. 2. Converter in operating position.

Figure 3 shows the code conversion circuitry on the left side, mounted on a retractable gate and accessible behind the side panel. The extended drawers house the power supplies for the conversion circuitry and punches.

A detailed description of the equipment and its method of operation follows:

a. Tape Readers. Two standard paper tape readers (model CX) manufactured by Teletype Corp., Chicago, Illinois, are provided for reading Baudot and Fieldata coded input tapes. Figure 2 shows the readers in front of the left pedestal. The Baudot reader on the left and the Fieldata reader on the right are shock mounted on a retractable tray.

The readers have a power-on switch at the left and a control switch on top of their housings. The housings are removable for access to the drive motor, timing fly wheel, and contact points. Both readers are the mechanical reading type which employ tiny metal fingers to engage the holes in the input tape. Electrical



K1851

Fig. 3. Converter power supply and conversion circuitry.

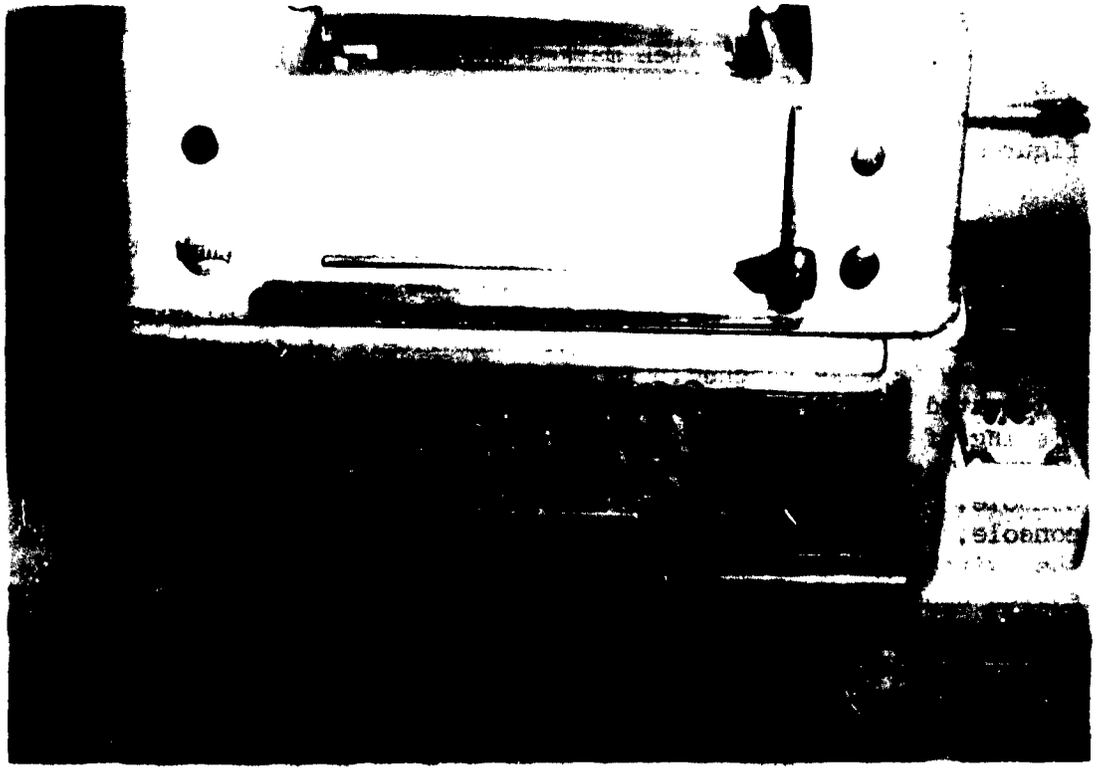
contacts are made by those fingers which pass through the holes representing the code for an alphanumeric character. These contact pulses are transferred serially to the code conversion circuitry for processing to the output function of the paper tape punches.

b. Tape Punches. Two Teletype punches (model BRPE) provide the output capability for both Baudot and Fieldata coded tapes. Figure 2 shows the tape punches in front of the right pedestal. They are mounted in the same manner as the tape readers.

The punches have a power-on switch at the lower right front of the housings with a tape feed switch for running out blank tape located at the top right of the front face cover. Tape is fed from a reel at the right of the housing.

Piston-type cutters which are activated by mechanical linkages to solenoid contacts perform the punching action. These components are accessible behind the plexiglass cover. The louvered cover at the rear is removable for access to the driving motor.

c. Page Printer. The Teletype page printer (model 28) produces a hard copy of the characters punched on the output tape. The printer keyboard is used to manually punch tapes in either code. Figure 4 shows a close-up of the page printer keyboard. The keyboard is standard for the characters of the two coding systems. The printer top which is hinged (Fig. 3) provides access to the paper supply and to the working parts.



K1853

Fig. 4. Converter keyboard.

d. Code Conversion Circuitry. Electronic circuitry of the Converter provides input-output control, code conversion, and asynchronous operation of the mechanical components. All solid state circuitry is employed using standard IBM printed circuit cards. Figure 3 shows the placement of these cards in the card gate which can be extended as shown for ease in maintenance. The heart of this complex is three specially built diode matrix cards located in the center of the gate. These cards contain the information for producing on tape, all codes in both systems.

e. Control Console. A switching control console for selecting the input and output devices is located at the right of the page printer (Fig. 2). Three switches labeled INPUT, OUTPUT, and TYPEWRITER SELECTION are provided. The INPUT switch is used for selection of Baudot, Fieldata, or keyboard input. The OUTPUT switch chooses the appropriate punch to be used for paper tape output. The TYPEWRITER SELECTION switch controls the choice of hard copy output (PRINTER selection) or no hard copy (OFF selection). This switch is placed in TYPEWRITER position for keyboard input.

Also located on the control console is a red button marked START for initiating all operations with paper tape input. A two-position toggle switch marked SHIFT OFF and NORMAL is located just to the left of the START button. This switch in the SHIFT OFF position performs a special function to gate out all letters or figures shift codes from an output Fieldata tape.

f. Method of Operation. The Converter operates as a code-for-code conversion device which obtains input information from punched tape via the tape readers. Input codes representing certain characters of the input system are converted to corresponding punched tape codes for the same characters of the output system, and a new tape is punched. In addition, tapes can be reproduced or originated from the printer keyboard in either system. A hard copy listing of the output tape can be obtained with all of these operations. Thus, 10 modes of operation are available from the operator's console. Table I shows these modes of operation. The operator's console, located to the right of the page printer (Fig. 2), affords the switching capability for each of the operating modes. A toggle switch beneath the keyboard allows the operator to shut off power to the punch drivers and produce a hard copy of the input tape without producing an output tape. This additional feature is included in the aforementioned table.

Figure 5 shows a block diagram of the flow of information from any of the input devices to one or more output devices. A flow path can be traced from left to right for all possible modes of operation.

Table I. Modes of Operation

INPUT	OUTPUT				
	Low Speed With Hard Copy		High Speed - No Hard Copy		HARD COPY ONLY
	BAUDOT	FIELDATA	BAUDOT	FIELDATA	
BAUDOT	X	X	X	X	X
FIELDATA	X	X	X	X	X
KEYBOARD	X	X			

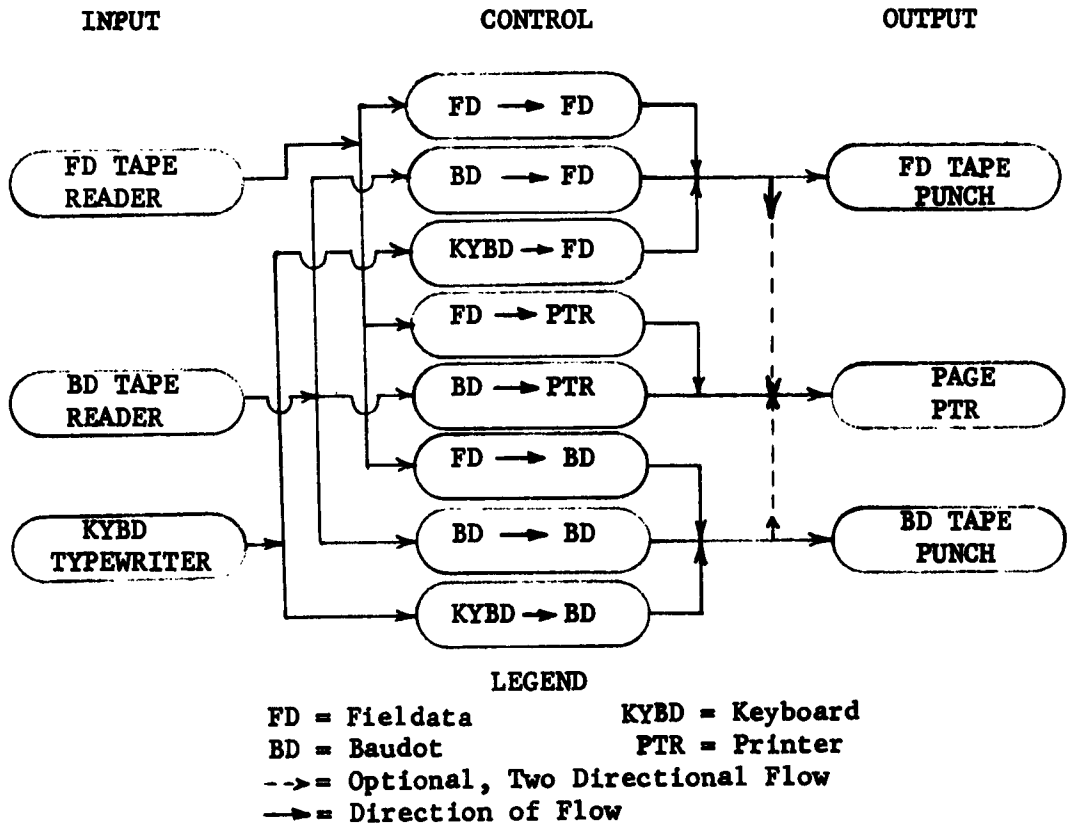


Fig. 5. Flow Diagram. Modes of operation.

The physical process of code conversion is merely the exchange of a punched paper tape code from one coding system for a corresponding punched code representing the same numeric, alphabetic, or control character in another system. The Baudot and Fieldata coding systems are the only ones which are interchanged by the Converter. Table II shows a sample listing of binary codes for characters in these two systems. A "one" in these codes represents a punched hole in the tape and, conversely, a zero represents no hole in the tape. It will be noted in Table II that five bits are required to represent a character in Baudot code and eight bits define the code in Fieldata. Thus, a wider tape, 8-channel, is required for Fieldata code. The characters which appear in each coding system are the numeric, alphabetic, and special characters found on a standard typewriter keyboard. It is the job of the Converter to make the exchange of binary codes automatically and to produce a coded output tape with a one-for-one correspondence with the coded input tape.

Table II. Sample of Encoding Table

Baudot Code	Character	Fieldata Code
10111	1	10110001
10011	2	10110010
00001	3	00110011
01010	4	10110100
10000	5	00110101
10101	6	00110110
.	.	.
.	.	.
.	.	.
00011	A	11000110
11001	B	01000111
01110	C	01001000
01001	D	11001001
.	.	.
.	.	.
.	.	.
01001	$	00100111
11101	?	10101100
11010	+	00100010
00011	-	00100001
.	.	.
.	.	.
.	.	.

4. Test Procedure. It was the basic purpose of all tests performed on the Converter to determine compliance with performance characteristics established by the purchase description and to determine the capabilities and limitations of the machine as an in-house device for converting data tapes. It was proposed that tests of the Converter should be designed to investigate two major areas. The first battery of tests covered all aspects of the operational capability of the Converter. A second test procedure was to determine, to a limited extent, the reliability of the mechanical and electrical components and to eliminate borderline components. These tests were performed from 1 January 1962 through 16 May 1962.

a. Operational Capability. It was the purpose of the operational capability tests to investigate the quality of output and speed of operation with respect to meeting the minimum requirements of the purchase description. As defined by this test procedure, the quality of output was merely the proper code for code transfer between the input and output devices. All modes of operation were checked for the proper punched tape, hard copy output, or both. Further tests were performed to check the two operating speeds for the proper 10- and 50-character-per-second rates.

b. Reliability Tests. It was the purpose of these tests to investigate reliability by continuous operation of the Converter over a relatively short time period. No attempt was made to produce a long-term reliability forecast. The consideration here was given to the elimination of borderline components which may have been made critical during construction or during shipment. The procedure used was to stress these components to failure by exercising the Converter to a maximum in a given period of time. This time period was defined as 5 normal work days during which the Converter was operated continuously under a given sequence of tests. The testing sequence was designed to quickly pinpoint any intermittent errors which might occur.

5. Test Methods. The methods which were employed to test the capability and reliability of the Converter required only a few specially prepared punched tapes and a stop watch. The tapes were prepared for both Fieldata and Baudot codes, and all punched characters were checked for accuracy against an encoding table. These tapes then provided a control base for checking the tape output of all modes of operation. The punched information was arranged in convenient groups so that errors in hard copy output could be quickly distinguished. The stop watch was used to check the rated speed of operation of readers and punches.

a. Operational Capability Tests. The basic premise of the operational capability tests was to exercise each mode of operation to a sufficient extent so that a valid check could be made of the accuracy of the punched tape and hard copy output. Control tapes were prepared in Fieldata and Baudot codes with the following formats:

(1) 1234567890 (four spaces)
ABCDEFGHIJKLMNOPQRSTUVWXYZ (two spaces) -
$&:()"/:;?,. carriage return, line feed

(2) Q1W2E3R4T5 etc. (top row of keyboard) two spaces A-SD$F! etc. (middle row keyboard) two spaces Z"X/C: etc. (bottom row) carriage return, line feed

(3) All numbers, letters, and special characters punched serially in equal groups of twenty duplicate characters, (i. e., 11111111111111111111 Carriage return, line feed 22222222222222222222 C.R., L. F. AAAAAAAAAAAAAAAAAAAA C.R., L. F.)

Figure 6 shows a sample of tape format 1.

Each of the six control tapes were used to initiate sequence of operations and to check the punched tape output. The method of checking output tapes is described in Appendix B. Hard copy output, as shown in Table III, was checked visually for errors which might or might not show up in the output tapes. The following testing sequences were employed:

Test	Input	Output	Output Check
1. Low-Speed Conversion	Control Tape	Opposing Code Output Tape & Hard Copy	Opposing Code Control Tape, Visual Check on Hard Copy
	Opposing Code Output Tape	Control Tape Duplicate & Hard Copy	Control Tape, Visual Check on Hard Copy
2. High-Speed Conversion	Control Tape	Opposing Code Output Tape	Opposing Code Control Tape
	Opposing Code Output Tape	Control Tape Duplicate	Control Tape

3. Low-Speed Reproduction	Control Tape	Control Tape Duplicate & Hard Copy	Control Tape, Visual Check on Hard Copy
4. High-Speed Reproduction	Control Tape	Control Tape Duplicate	Control Tape
5. Listing	Control Tape	Hard Copy	Visual Check

When an error was noted in the output tape in the first part of a two-part test (1 and 2 of the previous testing sequences), the remainder of the test was discontinued. All 5 tests were repeated 10 times with each of the 6 control tapes. Thus, a total of 300 tests were run in this phase.

Two prepared tapes and a stop watch were used to check the 10- and 50-character-per-second rated operating speeds. One tape each for Fieldata and Baudot codes were punched with a random combination of 2,000 characters. These control tapes were used for input to previous tests 1 through 4. Maximum operating times for the rated speeds were set at 200 seconds for tests 1 and 3 and 40 seconds for tests 2 and 4. The operation of each test was timed with the stop watch. No attempt was made to determine the precise operating speeds; rather, an approximate operating speed was noted for each test.

Throughout the operational capability tests, observations were made in the following areas:

(1) Ease of operation

(2) Ease of maintenance

(3) Maintenance requirements

(4) Environmental factors

No minimum standards had been set by the purchase description in these areas. However, the performance in these areas was noteworthy as an indication of the capability of the machine to perform its specialized function.

b. Reliability Tests. The basic idea of the tests for reliability was to operate the Converter continuously for a sufficient period of time to cause any weak electronic or mechanical components to fail. After failure of a component, testing was terminated, the Converter was debugged, and the deficiency was corrected.

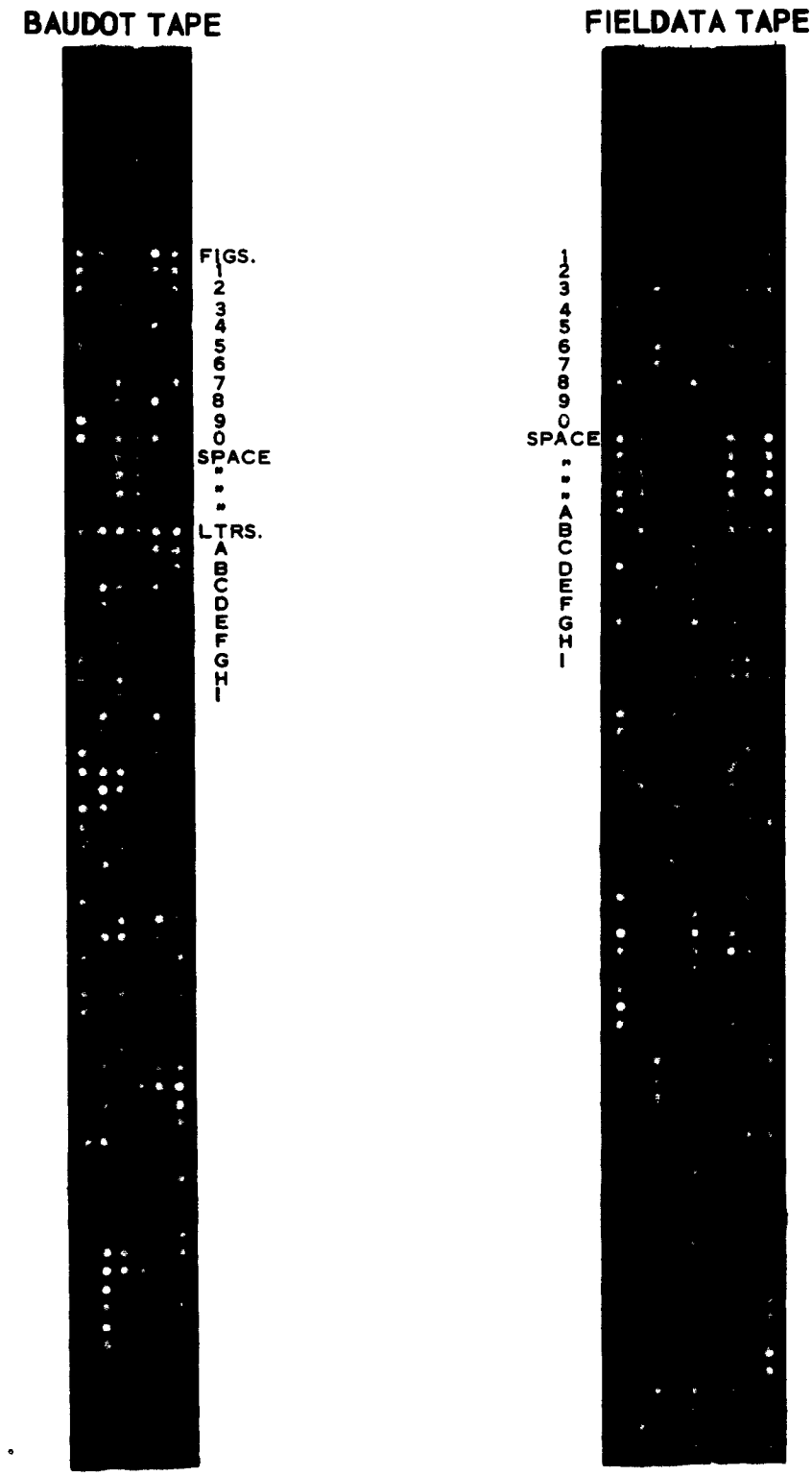


Fig. 6. Input control tapes.

Table III. Hard Copy Output

```
TEST NO 1:

12345678 90      ABCDEFGHIJKLMNOPQRSTUVWXYZ   -$!&@'()"/:;?,.
12345678 90      ABCDEFGHIJKLMNOPQRSTUVWXYZ   -$!&@'()"/:;?,.
12345678 90      ABCDEFGHIJKLMNOPQRSTUVWXYZ   -$!&@'()"/:;?,.
12345678 90      ABCDEFGHIJKLMNOPQRSTUVWXYZ   -$!&@'()"/:;?,.
12345678 90      ABCDEFGHIJKLMNOPQRSTUVWXYZ   -$!&@'()"/:;?,.
12345678 90      ABCDEFGHIJKLMNOPQRSTUVWXYZ   -$!&@'()"/:;?,.

TEST NO 2:

Q1W2E3R4T5Y6U7I8O9P0   A-SD$F!G&H@J'K(L)   Z"X/C:V;B?N,M.
Q1W2E3R4T5Y6U7I8O9P0   A-SD$F!G&H@J'K(L)   Z"X/C:V;B?N,M.
Q1W2E3R4T5Y6U7I8O9P0   A-SD$F!G&H@J'K(L)   Z"X/C:V;B?N,M.
Q1W2E3R4T5Y6U7I8O9P0   A-SD$F!G&H@J'K(L)   Z"X/C:V;B?N,M.
Q1W2E3R4T5Y6U7I8O9P0   A-SD$F!G&H@J'K(L)   Z"X/C:V;B?N,M.
Q1W2E3R4T5Y6U7I8O9P0   A-SD$F!G&H@J'K(L)   Z"X/C:V;B?N,M.

TEST NO 3:

1111111111111111111111111111111111111
2222222222222222222222222222222222222
3333333333333333333333333333333333333
4444444444444444444444444444444444444
5555555555555555555555555555555555555
6666666666666666666666666666666666666
7777777777777777777777777777777777777
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9999999999999999999999999999999999999
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AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
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Tests were then resumed and operation continued until more failures occurred or until it was evident that this relatively short-term operation would produce no more failures. As an estimate, a normal work week was chosen in which to complete all aspects of these tests. No consideration was given to controlled testing under adverse environmental conditions or improper maintenance.

The same control tapes as described in paragraph 5a were input to tests 1 and 2 of the previous testing sequences. Test 1 was repeated continually with each control tape for a 1-hour period. The hard copy output was examined during operation, and all errors were marked. The punched tape output of test 1 was compared to the control tapes at regular intervals, and any errors detected were marked on the tape. Test 2 was executed repeatedly with each control tape for 10-minute periods, and the punched tape output was examined for errors against the input control tape.

6. Test Results. Only those results which have a direct relation to specific requirements of the purchase description are discussed here. Observations of general performance are included in paragraph 8.

a. Quality of Output. No major deficiencies which affected the output quality were found during any of the capability tests. The following minor errors were detected and subsequently corrected:

(1) Tests with control tape 1 showed that a bit was consistently omitted from the Fieldata character "8" on the output tape. The erroneous code, however, was recognized by the Fieldata reader, and the proper conversion was made to the Baudot "8." This condition was corrected by inserting a diode in the code matrix card in the proper bit position. The absence of this diode had been overlooked during fabrication of the card.

(2) Operations with control tape 3 revealed a sluggishness of the punches in terminating a series of duplicate characters. Investigation showed that the punch power supply voltages were double their rated values because of faulty wiring. Wiring changes were made and the malfunction was corrected.

b. Speed of Operation. The following average operating speeds were determined for the four modes of operation tested:

MODE OF OPERATION	OPERATING SPEED
1. Low-Speed Conversion	10 Characters per Second
2. High-Speed Conversion	50 " " "
3. Low-Speed Duplication	12 " " "
4. High-Speed Duplication	52 " " "

c. Reliability. During the prescribed one-week test period the reliability tests were halted three times for the correction of deficiencies. The following corrective actions were taken: (1) Two printed circuit cards containing marginal transistors were replaced with spare cards. (2) Both tape punches were thoroughly cleaned with solvent and re-oiled. (3) Two new circuit cards were added to gate out some erratic pulses. (4) A heat-damaged diode was replaced in a circuit card.

After these deficiencies were corrected, the Converter was operated continuously for a period of 2 working days without the occurrence of a single output error. It was judged at this point that the reliability tests were complete for the purpose intended.

III. DISCUSSION

7. Examination of Test Methods. Methods of testing the Converter, as previously described, were designed to investigate the capabilities of the machine by merely exercising all of its modes of operation. These methods were simple and only sufficiently accurate to satisfy the intended purpose. No tests were run under adverse operating conditions because the machine in its present form would never be required to meet other than normal controlled conditions of a laboratory.

The methods described in paragraph 5 were devised so that a mass of printed and punched output could be rapidly checked for accuracy. The visual inspection of this output was the only practical means of checking for errors. For this reason, short tests were run repeatedly, and visual inspection became only a matter of looking for irregularities in the pattern of the punched output, the printed output, or both.

Operating speeds were timed with a stop watch. This method was sufficiently accurate to make a valid determination of whether specified operating speeds were truly accomplished by the Converter.

It was realized at the outset of the reliability tests that a long-term prediction of reliability could not be obtained from one week of testing. These tests might have been more aptly named "Debugging Tests." The methods, however, proved to be sound, as the results show that several marginal components were eliminated. These components were potential trouble spots which would have been extremely difficult to locate if not stressed to failure by methods such as those employed. Control tape 2 was instrumental in the reliability tests for taxing the capabilities of the Converter to a maximum. The input from this tape required the Converter to shift between letters and figures with each character read in.

8. Analysis of Test Results. The test results as described in paragraph 6 are somewhat self-explanatory. The quality of the punched and printed output was proved to be accurate except for minor errors which were corrected. It was determined that the operating speeds do meet the specifications for 10 and 50 characters per second. It can be stated from the reliability tests that several trouble spots were detected and subsequently corrected. These results, however, cannot give an accounting of the general performance of the Converter with respect to its capabilities and limitations as a working tool. Only personal observation and experience can supply this information. The following observations are believed to be pertinent:

a. Ease of Operation. The arrangement of mechanical components and operating controls is not adequate from a human factors standpoint. The operator cannot perform all operations from one position. The printer keyboard and operating controls are at the proper height for standing operation, whereas the readers and punches are on a level for operating from a sitting position. This arrangement causes considerable operator fatigue. Other undesirable operating conditions are: (1) Readers and punches are very noisy. (2) No holders or catch bins were included for convenient handling of input and output tapes.

b. Ease of Maintenance. Normal preventive maintenance of the mechanical components can be performed by laboratory personnel. Special tools are not required for preventive maintenance and electronic circuitry is easily accessible for checkout as shown in Fig. 3. The mechanical components are adequately designed for access to points where periodic lubrication and adjustment are required.

c. Maintenance Requirements. Under normal conditions, no preventive maintenance or checkout is required of the electronic components. Conversely, the mechanical components require a regular maintenance program. Relatively few adjustments have been required

but continual generous lubrication has been necessary. All of the mechanical components use felt wicks for lubrication of moving parts. A viscous oil must be applied to these wicks to prevent excessive loss of oil. Number 30, high-grade, nondetergent motor oil has proved satisfactory.

d. Environmental Factors. No testing was purposely conducted under adverse environmental conditions. However, out of necessity the Converter was located for a short time in a building without controlled temperature and humidity. Performance under these conditions was erratic and generally unsatisfactory. This evidence and the manufacturer's recommendations have led to the conclusion that controlled temperature and humidity are required for good performance.

9. Evaluation of Equipment. It has been illustrated that the Converter is versatile and provides all useful modes of operation. It can be readily visualized that this machine has the capabilities of a production device at a computer complex. The Converter would have numerous applications, some distinct advantages, and some limitations for such a task. These applications, advantages, and limitations are as follows:

a. Applications. The following applications could feasibly be accomplished by the Converter:

(1) Duplication and origination of computer program tapes for the Recomp II or Fieldata computers.

(2) Listing, off line, output from a Recomp II or Fieldata computer.

(3) Preparation of input data tapes for the applicable computers.

(4) Translation of the output from Fieldata simulation on the Recomp II to productive programs on Fieldata tape.

b. Advantages. Primary advantages of the Converter are in its flexibility and operating speed. The operator can switch rapidly from one mode of operation to the next. This flexibility is augmented by the numerous modes of operation which are available and by two operating speeds. Two operating speeds add the advantage of optimized performance. High-speed operation is adequate for most purposes, and low-speed operation is standard for electric typewriter output.

The Converter compares favorably with commercial machines which perform some of the same functions. No commercial machine has been found which will perform all of the functions accomplished by the Converter. In general, these machines have only one operating speed to perform all of their tasks. If a typewriter is provided, the rate will be 10 characters per second. If no hard copy output is available, the speed will range from 30 to 50 characters per second.

c. Limitations. A major limitation of the Converter can be found in its restricted vocabulary of Fieldata characters. Four Fieldata characters have no equivalence in the Baudot system. These characters are: <, = , > , and Special. No provision was made for duplicating a Fieldata tape bearing these characters or for punching them on tape from the keyboard.

The Fieldata coding system includes numerous control characters together with the alphanumeric characters previously discussed. These characters provide the control functions required in the storage and transmissions of data throughout the Fieldata family of computers. Again, no provision was made for duplication or generation of these characters with the Converter.

The Converter has a decided disadvantage in the manual preparation of tape in either code. The tape punches have no provision for feeding a discrete number of blank spaces on the output tape. This is also a disadvantage in the correction of errors on a tape.

IV. CONCLUSIONS

10. Conclusions. It is concluded that:

a. The Converter will perform the specialized code conversion function for which it was designed and can be used in a production facility where this function is required.

b. The operational capability of the Converter, including quality of output and speed of operation, meets the requirements of the purchase description.

c. The general arrangement of mechanical components is inadequate from a human factors standpoint.

d. A continual preventive maintenance program, primarily for lubrication, is required. This program can be administered by laboratory personnel.

e. Controlled temperature and humidity are necessary for good performance.

APPENDICES

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APPENDIX A

AUTHORITY

RDT & E PROJECT CARD

1. TYPE OF REPORT: ☐ NEW ☐ FINAL ☒ REPLACES (No. & Date) 8T35-11-009-09 11 May 1962
REPORT CONTROL SYMBOL: CSCRD-1 (R3)

2. PROJECT TITLE (TASK)
UTILIZATION OF RADAR PRESENTATIONS FOR TOPOGRAPHIC MAPPING (U)

3. SECURITY OF PROJECT: Unclas

4. PROJECT NO. (TASK): 4A623501D85309

5. 6.21.35.01.1

6. REPORT DATE: 1 January 1963

7. BASIC FIELD OR SUBJECT
RD Category
Exploratory Development

8. SUB FIELD OR SUBJECT SUB GROUP

9. CATEGORY: DT

10a. COGNIZANT AGENCY: Office, Chief of Engineers

b. DIRECTING AGENCY: Topo Sci Div., OCE

c. REQUESTING AGENCY: Office, Chief of Engineers

11a. CONTRACTOR AND/OR GOVERNMENT LABORATORY
GIMRADA, Ft. Belvoir, Va.
Boller & Chivens, Inc.
Goodyear Aircraft Corp.
Goodyear Aircraft Corp.

b. CONTRACT NUMBER
DA-44-009 ENG-4644
DA-44-009 ENG-4997
DA-44-009 AMC-23(X)

12. PARTICIPATION BY OTHER MILITARY DEPTS. AND OTHER GOVT. AGENCIES
Army Materiel Command
(See 23f(1) and (2))

14. SUPPORTING PROJECTS

16. EST. COMPLETION DATES
DEV. Continuous Task
ENGR TEST.
USER TEST
OPERATIONAL

13. COORDINATION ACTIONS W/OTHER MILITARY DEPTS. & OTHER GOVT. AGENCIES
USAF
AMC

18. DATE APPROVED
See Item 23f

19. PRIORITY

17. BUDGET CODE: 5600

20.
CDOG 1510b(6)

21. SPECIAL CODES

19. EST. SUPPORT LEVEL
☐ UNDER $50,000
☐ $50,000 - $100,000
☐ $100,000 - $250,000
☐ $250,000 - $500,000
☒ $500,000 - $1,000,000
☐ OVER $1,000,000

22. REQUIREMENT AND/OR JUSTIFICATION

A need exists for research and study leading to the development of an all-weather topographic radar mapping system. Radar sensors permit acquisition of terrain data under adverse weather and light conditions and will enable mapping missions to be performed expeditiously whenever required. Development of this system will substantially improve combat effectiveness and in addition, will augment peacetime mapping capabilities particularly in areas which are predominately overcast throughout the year.

23. Brief of Project and Objective.

a. Brief: The primary objective of this task is to advance the state of the art of radar mapping and provide the basis for the development of a world wide all-weather contour mapping system.

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RDT & E PROJECT CARD CONTINUATION	REPORT DATE	PROJECT NO. (TASK)
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b. Approach: It is proposed to conduct basic studies, investigations, research, and feasibility tests to advance the state of the art in all aspects of radar, in order to establish detailed requirements and specifications leading to the development of a complete topographic radar mapping system. Based on the state of the art, efforts will be directed toward development of a planimetric radar mapping system to be used in the interim period until such time that the topographic capability is available. Investigations of the principles for a topographic system will be performed simultaneously with the development of the planimetric system in order to realize the ultimate capability as soon as possible.

c. Tasks: None

d. Coordinated Test Plan (CTP) - N/A

e. Other Information: None

APPENDIX B

VISUAL TAPE CHECKING METHOD

This Appendix describes the methods used to check for errors in the output tapes obtained from the applicable tests described in paragraph 5 of this report. The procedure outlined herein is recommended in the performance of future tests or for routine checking purposes.

1. General. Punch a control tape for the input code and another for the output code both having an identical sequence of characters. It should be noted from Fig. 6 that letters and figures shift codes must be used with the Baudot system but are not required with Fieldata. Use the input control tape for input to the given test. The output control tape is used to check for errors in the output. The input control tape can be used for error checking a duplicate output tape.

2. Test Procedure. Place the output tape on the bottom of the output control tape so that the sprocket holes (smaller holes running the length of the tape) on both tapes line up. Slide the tapes over each other so that the lead characters on both tapes line up. Inspect the tapes from above. Look particularly for bits which do not show through both tapes. These bits have been dropped from the output tape. Turn the tapes over and inspect them again for bits which do not show through. These are added bits on the output tape. Mark the positions of errors on the output tape for future reference and clarification.

During the inspection process, it is best to hold approximately 2 feet of tape between the hands. After this length is carefully inspected, a second length, which overlaps the first by 2 or 3 inches, is inspected, etc. It may be necessary to shift the tapes slightly from time to time so that the sprocket holes are always in alignment. The differential stretch of the tapes causes some misalignment.

3. Errors to Look For. Frequently occurring errors will be readily apparent as missing or added bits in the output tape. However, meticulous inspection is often necessary to uncover singular errors in a long output tape.

Close attention is required for detection of the following types of errors:

(1) Skipped spaces

(2) Extra characters (beginning and end)

(3) A character punched over the preceding one

These types of errors will cause misalignment of all remaining characters and may incorrectly be attributed to stretch in the tape.

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TITLE Test and Evaluation of a Baudot-Fieldata Code Converter, Paper Tape

DATE OF REPORT 9 Aug 63 TASK 4A623501D85309 CLASSIFICATION Uncl.

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